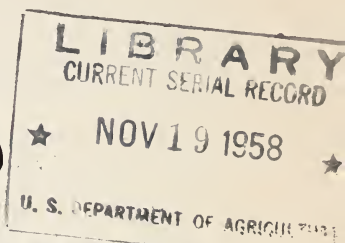


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Foreign Agricultural Report No. 109



CITRUS INDUSTRY *of Brazil*

By J. Henry Burke

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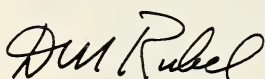
FOREWORD

Brazil is a minor producer of export citrus, but the second most important U. S. competitor in Europe's summer orange market.

This report evaluates fruit competitor's industry and forecasts the future for its fresh and processed fruit. The report is based on a survey made in 1957, and covers changes in the industry since 1942, when the Office of Foreign Agricultural Relations published "The Fruit Industry of Brazil," by Fred A. Motz.

In this report, all orange production is converted at 200 fruits to the box and all 1957 monetary data at 67 cruzeiros to the dollar, the 1957 Brazilian citrus export exchange rate.

The Foreign Agricultural Service presents this report as an aid to the U. S. citrus industry in the development of foreign markets.



D. M. Rubel
Director, Fruit and Vegetable Division

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CITRUS INDUSTRY OF BRAZIL

By J. Henry Burke
Marketing Specialist
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SUMMARY AND CONCLUSION

The commercial citrus industry in Brazil developed after World War I. Brazil began exporting oranges to Argentina about 1916, and to Europe in 1926. By 1939, exports to Argentina totaled over 2 million boxes and to Western Europe about 3.5 million, primarily to the United Kingdom.

After 1939, war stopped European trade and the virus disease, tristeza destroyed nearly 10 million trees, mostly in São Paulo.

Brazilian growers started replanting in 1946 and production is again increasing rapidly. All production for export is in the States of São Paulo and Rio de Janeiro. São Paulo will supply nearly all of the future export citrus.

Total orange and tangerine acreage in 1957 is estimated at 80,000 to 100,000 acres, of which not over 25,000 acres--mostly in São Paulo--are capable of producing export fruit. In 1957, 80 percent of São Paulo groves were less than 10 years of age. By 1965, total acreage may increase to 125,000 acres, primarily in São Paulo. Only 30,000 to 40,000 acres may be capable of producing export fruit.

Most new plantings are on Rangpur lime root. Trifoliate orange, sweet lime, and rough lemon are other roots used. The most important export variety is the late Pera. Early export varieties are the Hamlin and a small navel orange, which has a closed navel.

About one-third of the new plantings in São Paulo are low acid, nonexport varieties. Only one-fourth of Brazil's orange production can be exported because of its appearance and large size.

Total orange and tangerine production, estimated at 15 million boxes in 1956, included only 2 million boxes of export variety and grade. By 1965, orange and tangerine production may increase to 25 million boxes, of which only 6 million are likely to be of export variety and grade. Limitations on increases in production are (1) domestic and export fruit prices and (2) diseases, such as xyloporosis, exocortis, and gummosis. These diseases flourish on the tristeza-resistant rootstocks that have been in use since the tristeza epidemic. A third of the new plantings in São Paulo may be infected with

the dwarfing virus, exocortis, and as much as one-half of present plantings may go out of production by 1965. Replanting to combat disease may be a continuing aspect of citrus production. Most citrus is raised without irrigation and with minimum care. Fruit-destroying flies and disfiguring pests and diseases are major production problems.

The cash cost of operating an orange grove in 1957 is estimated at \$41 to \$70 per acre--22 to 33 U. S. cents per box. The cost of picking and packing is estimated at 79 U.S. cents to \$1.03 per box. Break-even costs were estimated at \$3.08 to \$3.63, c.i.f. continental European ports.

Brazil's marketing season in Europe is from June 15 to Oct. 15. Exports are marketed by fruit dealers, who purchase the crop on the tree and pick and pack both domestic and export fruit. Most of these exporting firms also import Argentine deciduous fruit.

Total 1957 orange exports were estimated at 1.5 million boxes--1.3 million to Western Europe and 200,000 boxes to Argentina.

Brazilian oranges have no outstanding competitive advantage. They usually sell at discounts to California and South African oranges because of size, appearance, and condition. As increasing supplies come from the State of São Paulo, Brazilian orange sizes will be even larger, and the export season shorter, ending in Europe about Sept. 15.

Brazil has lost most of its important prewar export market in Argentina and the United Kingdom. This loss will result in increased competition for U. S. summer oranges as Brazilian exporters search for new markets. The large size and poor quality of Brazilian fruit will limit competition, however.

The future outlook is for average annual exports to Argentina of about 250,000 boxes and not over 1 million boxes to the United Kingdom. Any major increase in exports will have to be made in continental Europe (in competition with expanding European deciduous production and established summer orange competitors).

Total orange exports may increase to about 2.5 million to 3 million boxes by 1961 and 4 million boxes by 1965. Further increases are unlikely under probable market conditions.

Brazil will continue to have a small domestic processing industry. Over one-half of the orange production is navel oranges or low-acid domestic varieties of little value for juice. Only soft drink bottlers were producing small quantities of juice in 1957. Essential oil of orange and lemon are the major products. These are produced by fresh fruit packers from residual fruit. Lemon oil brought the highest price--\$5.08 per pound.

A processing plant with U. S. machinery may be installed at Bebedouro. Brazil has no natural advantages for the development of a major processing industry. Should the country produce juice or essential oil for export, it would compete with the world, abandoning the seasonal advantage which created the fresh fruit export industry.

HISTORY

Oranges were brought to Brazil by the Portuguese about 1530. The commercial industry developed after World War I, but World War II stopped European trade. During the war, Brazil continued to supply Argentina with late oranges. The immediate effect of the loss of the European market was surplus supplies of oranges. Larger quantities were offered the domestic market and consumption is said to have increased. A great many were used for essential oil.

The surplus orange situation was changed drastically when the tree-killing virus disease, tristeza, destroyed most commercial groves in the State of São Paulo between 1942 and 1952. As groves were killed, production declined and oranges were in short supply between 1948 and 1952.

In 1946, growers began replanting oranges on tristeza-resistant roots, primarily Rangpur lime. The new plantings are showing evidence of infection with tree-stunting virus diseases, such as exocortis.

Production is increasing, but constant replanting will be necessary to maintain production. Only 10-20 percent of production will be exported.

ACREAGE

In 1957, total orange and tangerine acreage in Brazil was estimated at 80,000 to 100,000 acres. About 25,000 acres, mostly in the State of São Paulo, are commercial plantings, producing over 1 box of fruit per tree annually, and only about 15,000 acres of these are planted to export varieties and operated in a manner capable of producing oranges of export grade.

By 1965, total acreage may increase to 125,000 acres, of which 30,000 to 40,000 acres may be expected to be capable of producing export fruit.

PRODUCTION

Production by Variety

Oranges. --Brazil produces oranges primarily for the domestic market, and has never been a major producer of export citrus. Highest production was achieved in the period 1937-42. At that time, production was probably about 20 million boxes, of which not over 6 million boxes were of export variety and grade.

From 1940 to 1952, total production declined as tristeza killed all susceptible trees. Some trees in every State and most groves in São Paulo, the major export-producing State, were destroyed. By 1952, total production had declined to an estimated 9 million boxes--only 1.5 million suitable for exporting.

In 1956, total orange production rose to about 12 million boxes. About 2 million were export quality fruit (table 1).

TABLE 1.—Citrus: Estimated total production in Brazil, by type and by state, average 1935-39 and 1949-53, annual 1952-56¹

State	Average		1952	1953	1954	1955	1956
	1935-39	1949-53					
Oranges:	<i>Mil. boxes</i>	<i>Mil. boxes</i>	<i>Mil. boxes</i>	<i>Mil. boxes</i>	<i>Mil. boxes</i>	<i>Mil. boxes</i>	<i>Mil. boxes</i>
São Paulo.....	4.5	2.6	2.5	3.8	4.5	5.0	5.2
Rio Grande do sul.....	.5	.4	.3	.3	.4	.4	.5
Paraná.....	.4	.3	.3	.3	.3	.3	.3
Santa Catarina.....	.4	.4	.3	.3	.4	.4	.5
Minas Gerais.....	2.5	1.2	.7	.8	.8	.9	1.0
Rio de Janeiro.....	6.0	3.5	2.4	2.3	2.0	1.8	1.5
Other States.....	4.7	3.5	2.5	2.8	2.8	2.9	3.0
Total.....	19.0	11.9	9.0	10.6	11.2	11.7	12.0
Export variety and grade..	6.0	1.5	1.2	1.0	1.5	1.8	2.0
Tangerines:							
Total.....	4.0	2.0	2.0	2.5	2.6	2.7	3.0
Oranges and tangerines:							
Total.....	23.0	13.9	11.0	13.1	13.8	14.4	15.0
Lemons:							
Total.....	.5	.4	.4	.4	.4	.5	.5
Export variety and grade..	.1	.1	.1	.1	.1	.1	.1
Grapefruit:							
Total.....	.6	.3	.3	.2	.2	.3	.3
Export variety and grade..	.3	.1	.1	.1	.1	.1	.1

¹ Production is given in the year of the bloom - August and September of the year shown.

If the grade of fruit and transportation problems are ignored, the potential of orange production is almost unlimited. Vast areas exist where oranges can be produced without irrigation and with little care. The limiting factors in production are disease and the quantity of fruit which can be sold at a profit.

By 1965, total production may be expected to increase to about 20 million boxes, of which about 6 million may be of export variety and grade. After 1965, little increase in production can be expected. Disease may destroy significant percentages of new plantings, making constant replanting necessary. At 1965 production levels, citrus probably will be less profitable, and sugarcane, coffee, cotton, and other crops will compete for land.

Export production is shifting from Rio de Janeiro to the State of São Paulo. All export fruit is produced in these two States. Oranges for domestic use are grown in 20 other States. Even in export-producing areas, not over 25 percent of production is of export variety and grade.

Tangerines. -- Tangerines are popular fruits, in Brazil. In 1956, production was about 3 million boxes and, by 1965, may reach 5 million.

Lemons. -- Brazil produces a small quantity of acid lemons. São Paulo is the major source. In 1956, estimated total pro-

duction was about 500,000 boxes. Little increase is likely in the future. The humid climate is not conducive to lemon culture.

Limes. --Some limes are grown in scattered areas for local consumption. Production is reported to be small with only insignificant acreage in the major producing areas. Future output is likely to remain at about 250,000 boxes per year. However, there is extensive acreage available in climatic zones where limes could be grown.

Grapefruit. --Brazil's production of grapefruit probably does not exceed 300,000 boxes a year, although much larger quantities could be produced if there was a demand for them. Future production is likely to remain at about present levels because of lack of demand and the difficulty of keeping trees free of tristeza.

Producing Areas

Discussion of producing areas will be limited to the 6 States which produced 75 percent of Brazilian oranges in 1956. The States of Rio Grande do Sul, Paraná, Santa Catarina, Minas Gerais, and Rio de Janeiro will be discussed only briefly to evaluate their export potential. Detailed discussion of cultural problems and economic conditions will be confined to the State of São Paulo which will supply most of Brazil's export oranges in the future.

Rio Grande do Sul. --The small citrus industry of this State is located about 35 miles from Pôrto Alegre near Montenegro, Taquari, and Cáí. The planted area probably does not exceed 5,000 acres. The total production of citrus in the State of Rio Grande do Sul is probably no more than 500,000 boxes, most of which is sold in Pôrto Alegre. These estimates based on field observation (in August 1957) are quite different from official data, which credit the State with about 45,000 acres of citrus and an orange production of about 4.5 million boxes.

The citrus area is in rolling country, much of which is forested with eucalyptus and acacia, the bark of which--known as wattle bark--is widely used in the tanning industry. The groves are usually small, containing 1,000 to 2,000 trees. A turf culture is followed, and there is little or no fertilization or pest control. Some growers pile a mulch of vegetation around each tree. Some old groves are being removed and some have been abandoned.

About 60 percent of the present plantings are less than 8 years of age. The Pera and navel oranges are the most important varieties. Some Valencia oranges are being planted, as well as lemons and large tangerines. All rootstocks are Rangpur lime or sweet orange and are resistant to tristeza.

Oranges bloom Aug. 15 to Sept. 15. Navel oranges are harvested May to September and Valencias and Peras, September to December.

Important diseases are melanose, scab, gummosis, and tristeza. Major pests are Florida red, purple, and white scales, rust mite, and the Mediterranean and other fruit flies.



Interplanting is practiced in parts of Brazil. Mandioca (a root starch) is planted in this better-than-average grove in Rio Grande do Sul.



Irrigation and fertilization increase the yields of these excellent Pera orange trees near Araras, São Paulo.

Some growers use paper sacks around fruit to protect it from fly damage. The situation of most groves makes it very difficult to carry out pest control operations. A spray rig on wheels cannot be used because of the steep slope of the ground.

Growers have been receiving good prices for their late Pera oranges. In 1956 the price was reported to be 90 cents to \$1.04 per box on the tree.

Many small nurseries of rather poorly grown trees were observed. These indicate that planting may continue. Budded trees were reported to be selling for 10.00 to 12.00 cruzeiros (15 to 18 cents) each in 1957.

Citrus processing is confined to the extraction of some orange oil.

In the future Rio Grande do Sul will remain a small producing area for Pôrto Alegre and other local consumption. Growers anticipate the possibility of export to Argentina, but it is doubtful if such trade will develop. Brazilian oranges are expensive in Argentina; therefore only the best quality fruit is shipped.

Santa Catarina and Paraná. -- These two States grow citrus which is consumed in the producing areas and in the larger cities. Only very small quantities of fruit are reported to be shipped to other parts of Brazil. Any shipments would be made through the port of São Francisco.

In Santa Catarina most of production is in the low coastal area near Joinville in the São Joaquim Valley and near Itajaí. This coastal zone is relatively free from frost.

The State of Paraná has two producing zones. The low coastal area as in Santa Catarina near Paranaguá in the Cêrro Azul Valley and along the northern edge of the State, near Londrina. Both are relatively frost free zones.

In both States citrus receives little cultural care, being raised as a turf culture with little pest control or fertilization. Seedlings were raised exclusively in the past but some budded varieties are now being grown.

The citrus producing area in Paraná near Londrina is also quite close to the citrus area in the State of São Paulo which is infected with type A citrus canker. While the infected area in São Paulo is quarantined it is possible that the infection could spread into Paraná. The Paraná citrus industry is not well organized. Under these conditions an infection could become well established in Paraná before it was detected. An infection with citrus canker would be difficult to control where citrus is of little importance and few people have a substantial interest in the industry.

Official Brazilian statistics credit Paraná with a production of 2 million boxes of oranges and Santa Catarina with 1.7 million boxes, but field observations indicated that orange and tangerine production probably does not exceed 300,000 boxes per year in Paraná and 500,000 boxes per year in Santa Catarina.

There is a small processing plant reported in Santa Catarina which produces essential oils and orange juice. In 1956 the plant was reported to be paying 460 cruzeiros or \$6.76 per metric ton for oranges at the plant.

Most fruit is marketed in both States by truckers who drive to the producing areas and buy fruit. Oranges are hauled in bulk and often sold from the truck in the market.

In Paraná oranges were sold for 1 cruzeiro each, about 18 cents per dozen in 1957.

In the future these two States will continue to produce small quantities of citrus for local consumption. They do not appear to have any potential for the production of export fruit.

Minas Gerais. -- The third most important area produced an estimated 1 million boxes of oranges in 1956, although official statistics indicated a 5.8 million box production. The major producing area is near Leopoldina at elevations of 1,000 to nearly 3,000 feet. There are some new plantings in the Belo Horizonte area. The most important commercial orange varieties are Pera, navel, Serra Dagua, and Campista. This is an early citrus district. Oranges bloom in July and August. Navel oranges are harvested from April through June and Peras in August.

Since 1942, tristeza killed more than 1 million trees in the Leopoldina district. To combat this disease most trees are now planted on Rangpur lime. Some trees are infected with exocortis. This disease has not been serious because disease-free clones have been used in tree propagation.

There are no packinghouses, and fruit is usually purchased on the tree by fruit buyers and hauled directly to market by truck without packing. Minas Gerais is a seasonal supplier of oranges to Rio de Janeiro from April through June. Beginning in August, Rio supplies Pera oranges to Minas Gerais. No export fruit is produced.

The outlook is for some increase in output from new plantings, but this is unlikely to result in any production for export. As in other sections of Brazil, there are large areas where citrus can be produced. The quantity grown will depend on domestic market prices.

Rio de Janeiro. -- Rio was once the most important export producing area. It is now a poor second to São Paulo, producing an estimated 1.5 million boxes of oranges in 1956--about 500,000 of export quality. Because of the very low yields, this probably represents production of from 30,000 to 40,000 acres. Official data credit Rio de Janeiro with a production of 7 million boxes.

Producing areas are all within 60 miles of Rio de Janeiro, both east and west of the city. The citrus areas are in the low coastal plain at elevations of 1,000 feet or less. In the older producing districts near Nova Iguaçu, Queimados, and Campo Grande, many groves are neglected and are going out of production because of the urbanization of the area as the city expands. There are some new plantings across the bay

east of Rio de Janeiro, near São Gonçalo, Itaboraí, Maricá, and Araruama.

Rio's losses from tristeza were small--not more than one-half million trees. Rangpur lime has always been used extensively as a rootstock. Only a small percentage of present plantings are on sweet orange root. The use of exocortis-free clones has prevented this disease becoming a problem.

The Pera is the most important orange variety. It is smaller than the Pera of São Paulo. Some local varieties are also grown, but every few navel oranges are produced in Rio de Janeiro. This is a late orange area; the bloom is in September. Navel oranges are harvested from May to July and Peras, from June to December.

April to July, Rio de Janeiro buys some oranges from São Paulo and Minas Gerais. Late in the year some Pera oranges are sold to Minas Gerais and São Paulo.

Rio de Janeiro has supplied all of the exports to Argentina and nearly all of the late exports to Europe. In 1957, total exports from Rio de Janeiro were about 500,000 boxes compared with 2 million boxes in 1950, reflecting Rio's declining production and importance.

This area has had difficulty with stem-end rot in exports. The neglect of groves has probably been responsible for some of this difficulty as the fungus is found on dead wood.

There are export packing and dockside cold storage facilities in the city of Rio de Janeiro.

There is some evidence of a shortage of late oranges in Brazil. São Paulo is unable to supply large quantities of fruit from September through December. The resulting high prices, evident in 1957, may stimulate the planting of Pera oranges in new producing areas further removed from Rio de Janeiro. Large areas suitable for such expansion are said to be available.

In the future, production may increase, but it is not likely to reach prewar production levels because of larger competitive supplies available in Argentina and Europe. Rio de Janeiro will probably be primarily a producer of fruit for the domestic market and expansion of production will be guided by domestic market prices.

São Paulo. --Present major producing areas are all situated on the interior plateau. Major plantings are located near Campinas, Limeira, Araras, Pirassununga, Pitanguieras, Bebedouro, and Araraquara. Prior to 1950, there were major plantings in valleys east and west of São Paulo at Taubate and Sorocaba. These are now minor producing districts. Only in Sorocaba are there new plantings of export varieties. Some tangerines are grown in the low warm humid coastal plain near Santos.

In the next 10 years, São Paulo will produce nearly all of Brazil's export citrus. Of the estimated 35,000 acres planted in 1957, about 20,000 acres are probably commercial. Nearly all citrus land has been used for other crops. The citrus area near Campinas and Limeira was first planted to

sugarcane when the jungle was cleared away. In about 1875 sugar was replaced by coffee. As the old coffee groves became nonproductive, citrus was planted. Sugarcane and coffee are planted extensively in the citrus areas. Most of the citrus groves are young. About 75 percent of orange plantings are less than 8 years of age and 80 percent are less than 10 years of age.

The production of oranges and tangerines was estimated at 5.2 million boxes in 1956, about 1.5 million of export variety and grade. Output can double by 1965 as new groves come into production. About 70 percent of the 1957 orange acreage is planted to export varieties, such as Hamlin, Pera, and the small navel, Bahianinha. Not over one-half of this fruit is clean enough to export, and one-third is too large to export. Production data of the State of São Paulo is the best in Brazil, usually about 25 percent higher than a harvested crop.

The climate of the State of São Paulo is extremely favorable for citrus production.

Oranges bloom in August. The Bebedouro area is earlier than Limeira by about 2 weeks. Nearly all of the orange producing area is at elevations of over 2,000 feet. There is a considerable difference in temperature between day and night. The blooming cycle of citrus is affected both by temperature and rainfall. While the main bloom is in August, oranges have other blooms during the year which may produce substantial quantities of out-of-season fruit.

The average rainfall is about 50 inches per year. Most of it occurs in the summer from September to April. The orange harvest season has little rainfall from April to September. This aids harvesting but it also means that the groves are often dry in August at the start of the bloom. In some years the first bloom is lost because of drought.

Frosts have occurred in parts of the São Paulo citrus area. In 1935 some fruit was frozen and nursery trees damaged. Lime and lemon trees are reported to have suffered some damage. The frost hazard, which is very slight is greatest around Limeira. The interior is said to be frost free. São Paulo may be considered to be free from severe frost.

Navel and Hamlin oranges are harvested from March to July and Peras, from June to September.

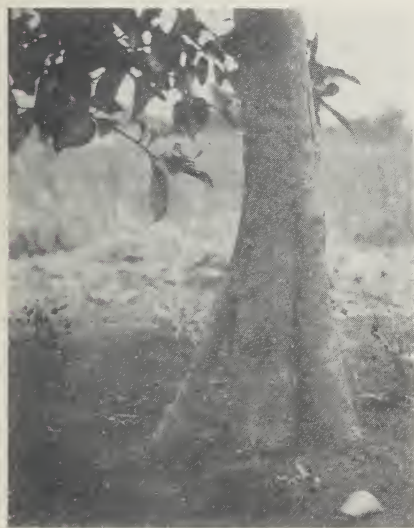
Citrus groves in São Paulo are large, mostly over 100 acres. In 1957, there were at least four groves which contained over 1,500 acres. One grove at Bebedouro may be the largest in the world in 5 years if present planting plans are continued.

Many growers raise other crops, such as coffee, cattle, sugarcane, grain, or cotton.

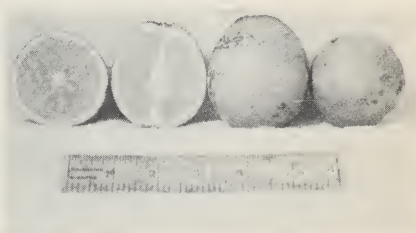
Most groves are on deep sandy loam soils on sloping ground. Planting distances are generous--24 by 24 feet, or 30 by 30 feet. Some groves are contour planted. Cultural care is rather casual and grazing cattle are used for weed control in some areas.



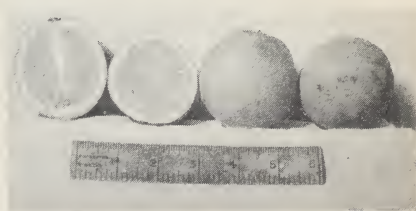
Mature groves are a rare sight in São Paulo because many trees have been killed by tristeza. These 24-year-old trees are grown on Rangpur lime.



Orange trees on Rangpur lime that show exocortis can often be saved by inarching with sweet orange, but the practice is not common.



The Pera, a late oval seeded orange is Brazil's No. 1 export variety.



The Bahianinha, a sport of the Washington navel orange, has a closed navel.

Groves are clean cultivated in the dry winter months--May to September--and weed cover crops are grown in the wet, hot summer. Weed crops may get very heavy when rainfall prevents cultivation. Cultivation is done with tractor-drawn equipment which is much larger and heavier than that in use in the United States. Deep cultivation is the result.

No irrigation is the rule; however, in periods of dry weather, in the winter and spring, trees may suffer from lack of moisture. There were some wilted trees in August 1957. It has been demonstrated that irrigation could greatly increase yields, but very few growers are prepared to use it. Adequate water for irrigation is available for development in most areas.

It is characteristic of Brazil that orange trees produce out-of-season fruit. As many as five sets were observed in some groves. This complicates picking and pest control problems.

Grower-owned power sprayers are used for pest control. Spraying is done from the ground. An adequate spray program for most areas includes a copper spray for scab in August before the bloom. Minor elements be added to this application, if necessary. An oil spray is applied in October for scale and a sulfur spray in December for rust mite. In addition, as many as 20 spot sprays for fruit fly may be necessary between April and October. Such a pest control program is required for the production of export quality fruit. Few growers have a complete spray program and many growers do nothing to control pests.

Fertilization is not as yet an important problem. Where fertilizer is used nitrogen and phosphates have been found to be the most important elements. Mixed fertilizers are used, such as 13-13-20. A usual application is 5 pounds per tree per year. Some manure is used, together with nitrates.

Some unfertilized groves will maintain commercial production for years. Vigorous 10-year-old groves were seen bearing commercial crops without any fertilization or irrigation. The foliage in these groves was dark green and heavy, and there was little evidence of minor element deficiencies. One such grove was the third citrus grove planted there in the past 40 years. None of these plantings had ever been fertilized. Brazilian soils are of volcanic origin and have remarkable fertility, but it is likely that as groves mature most will require some fertilization for consistent production of export citrus.

Fruit is often bought by a fruit buyer 3 months before harvest and there is little incentive for better cultural care when no increase in returns would result.

Rootstocks

Rangpur lime root is used for 80 percent of present orange plantings. It is susceptible to gummosis and exocortis or Rangpur lime virus diseases. Orange trees grown on this root produce a box of fruit per tree at 3 years of age under favorable conditions. Trees probably have a shorter life than

trees on sweet orange; they are more sensitive to minor element deficiencies and may be affected by xyloporosis.

Caipira sweet orange is the second most important root. Trees come into bearing more slowly than trees on Rangpur lime, but they have greater vigor and probably a longer commercial life. The quality of fruit is also superior.

Sweet lime of Israel, or "Lima da Persia," is third in importance. It has some tolerance to tristeza but is not resistant, according to reports. It produces weak trees which probably have a short commercial life. It also is susceptible to the virus disease xyloporosis.

Trifoliolate orange root is used to a minor extent. It is resistant to tristeza and is more resistant to gummosis than other roots; however, it is susceptible to exocortis. Orange trees grown on this root in Brazil do not show dwarfing, although they are smaller than those on sweet orange.

Rough lemon is a minor root and the strain grown in Brazil is reported to be different from that used in South Africa. Cleopatra mandarine is as yet a minor rootstock but it may increase in importance in the future.

Pests and Diseases

Pests. --Citrus scales are serious pests particularly in young groves. Florida red and purple scales are the most damaging. Rust mite is an important pest in all areas.

The black aphid is not only a tree-damaging pest, but is also the vector of tristeza. Both Argentine ants and leaf-cutting ants damage foliage.

The greatest loss of fruit is caused by three fruit flies, the Mediterranean fruit fly, the anastrepha, and the lonchea fly. These are not active in exactly the same season. Fly damage is greatest in the warm interior areas, as at Bebedouro, where the fly is reported to be active throughout the year. All of these flies sting fruits, depositing an egg which develops into a fruit-eating larva. As much as 50 percent of the late orange crop may be destroyed. There are many noncitrus hosts, such as coffee, to keep the fly population active. There was heavy fruit loss from fly damage in August 1957.

Natural control of scales by predatory insects and by fungus is obtained in some citrus groves. Such control is not complete, but may result in a fair percentage of clean fruit. When toxic sprays are used for scale or flies, pest control problems may be increased. Such sprays kill the predatory insects causing scale and rust mite infestations to increase in some cases. For this reason growers must compromise their pest control program and the result is that most groves produce substantial quantities of fruit made unfit for export by pests.

Diseases. --Virus diseases limit the expansion of citrus production in Brazil to a large degree.

Tristeza has been one of the most dramatically devastating diseases in the history of commercial citrus. Tristeza is a

tree-killing virus disease spread by the black aphid, which destroyed all orange, tangerine, and grapefruit trees in São Paulo on sour orange root between 1937 and 1952. It was in São Paulo that this virus first developed as a major disease and was identified and named.

Most of the experimental work on tristeza has been done in São Paulo. Recent experimentation has shown that there are several strains or mixtures of the virus in Brazil. These generally attack trees grown on sour orange rootstock and they vary from rather mild, slow-acting types to severe types which may quickly kill an orange tree on sour orange root or even attack the top of grapefruit trees grown on resistant rootstocks. Tristeza does not affect lemon trees grown on sour orange root.

To combat tristeza, orange, tangerine, and grapefruit groves have been replanted on resistant rootstocks. Some of these rootstocks--sweet lime, Rangpur lime, and trifoliolate orange--are affected by other virus diseases, such as exocortis, Rangpur lime disease, and xyloporosis. Thus tristeza continues to be a problem in a secondary manner.

Exocortis is an important virus disease affecting orange and tangerine trees grown on trifoliolate orange and Rangpur lime rootstock. Affected trees show dwarfing at 4 or 5 years of age and scaling of the bark below the bud union. They quickly become nonproductive.

Brazilian scientists believe the virus is dormant in sweet orange and tangerine scions and becomes active when trifoliolate root is used. Its effect, if any, on other rootstocks is unknown. There is no evidence that insects or seeds transmit the virus. Some U.S. scientists believe the disease on Rangpur lime is a separate virus disease and call it Rangpur lime disease.

Extensive field observations indicate that exocortis of trifoliolate and Rangpur lime roots is prevalent in new orange groves. At least one-third of 1957 orange acreage in the State of São Paulo appears to be infected. Important percentages of the newly planted Brazilian orange groves must be considered as not permanently commercial for this reason. Large acreages may become nonproductive in the next 5 years. As much as one-half of present acreage could go out of production by 1965.

Xyloporosis is a virus disease which has developed when sweet lime rootstock has been used for sweet orange scions. Xyloporosis is a tree-stunting disease and affected plants may be killed or rendered nonproductive within a few years. This disease is prevalent in new groves planted on sweet lime root. It may also affect trees grown on Rangpur lime root under certain conditions. Affected trees show marked deformity of the trunk bark above the bud union. The deformity caused by this disease in Brazil was severe.

Psorosis is probably present in many of the scion stocks being used in Brazil. Outbreaks were observed in the few mature groves seen. As groves reach maturity, it is likely that this virus disease will limit the potential of the expanded acreage.

Groves planted with unsatisfactory scion and rootstock combinations may be rehabilitated by inarching. In Brazil, inarching has proved to be a commercially effective way of making orchard-planted trees resistant to tristeza, exocortis, and Rangpur lime disease. Orange trees budded on sour orange root are resistant to tristeza when inarched with sweet orange or other resistant rootstock. A young tree which shows symptoms of exocortis or Rangpur lime disease will recover and grow in a normal manner when inarched with sweet orange root. In each case, the original root tends to disappear as the inarch grows. Inarching is not widely practiced in the State of São Paulo.

In addition to virus, tree-killing fungus diseases, such as gummosis and rubellosis are present. Old lemon groves budded on sweet orange rootstock were all infected with gummosis.

Sour orange root was resistant to gummosis, but highly susceptible to tristeza. Except for trifoliate orange root, all of the tristeza-resistant roots now used are more susceptible to gummosis than sour orange root. Tristeza has forced the use of roots which will increase damage by gummosis as new groves mature.

Brazil also has important fruit-damaging fungus diseases, such as melanose, stem-end rot, and scab. There are two types of scab reported. Sour orange scab which is severe on bitter orange, lemon, and grapefruit, affecting both fruit and foliage. Also present is a sweet orange scab. This affects fruit primarily.

Melanose causes fruit disfigurement in Brazil's humid summer climate. It can be controlled by copper sprays. This fungus is said to be the causal fungus for stem-end rot which has resulted in decay in export fruit. Gassing of fruit to add color is reported to increase the susceptibility of packed fruit to stem-end rot.

Citrus canker was identified in an interior citrus district in the State of São Paulo in 1957. The infection is reported to be type "A" which is the virulent strain. The area affected, about 120 miles by 50 miles, near the town of Presidente Prudente has been quarantined. No fruit or plants may be legally moved from the area, and affected plants are being destroyed.

While the State of São Paulo is taking protective measures, there is a possibility that the disease could spread in the State of São Paulo or become established in the citrus area of the State of Paraná which adjoins the quarantined area.

It is reported that this disease can be controlled by pruning and copper sprays, but the frequency with which such sprays would have to be applied probably precludes commercial use of such controls.

The commercial life of the new orange groves planted since 1946 will be limited by both the virus and other diseases. The extensive new groves are not permanent, and replanting to combat disease may be expected to be a continuing aspect of citrus in São Paulo.

Besides the difficulty of keeping trees alive, pests will continue to destroy and disfigure fruit, which will limit the quantity that may be exported and the price at which Brazilian fruit can be sold in European markets.

Experiment Stations

The Brazilian Government operates an experiment station at Nova Iguacu near Rio de Janeiro which carries on some experimental work on citrus.

The primary citrus experimental work in Brazil is done in the State of São Paulo by the Instituto Agronomico at Campinas. The citrus experiment station is located at Limeira. It is an extensive and well-staffed station. All citrus disease work is done here, including work on canker and tristeza. A wide range of experiments is being carried on, including work in rootstocks, fertilization, means of cultivation, types of tillage, nontillage, and various permanent and annual cover crops. The field trials on rootstocks, varieties, and cultural methods should prove to be especially valuable to São Paulo's expanding citrus industry.

The experiment station also raises some nursery trees for commercial sale.

Varieties

Following are Brazilian words for the citrus fruits:

Laranja (orange).

Laranja Bahia or Bahiana (navel orange).

Bahianinha (small navel orange).

Laranja lima (acidless orange).

Mexerica or bergamota or tangerina (common tangerine or European mandarine).

Laranja cravo (large tangerine or tangerine species).

Ponkan (largest tangerine or tangerine species).

Pomelo or grapefruit (grapefruit).

Toranja (shaddock).

Limão (lemon).

Limão doce (sweet lemon).

Limão pequeno or limão galego (lime).

Limã da Persia (sweet lime).

These are Brazil's most important orange varieties. There are many strains of each and considerable variation within varieties.

Pera orange. -- This is Brazil's best-known late export variety and probably represents 30 percent of commercial plantings. Trees are vigorous and produce well. The fruits are oval, of medium size, and similar to the Valencia in appearance. Some have a flat area at the stem end and some of the leaves have an indentation on one or both sides near the stem. Samples of fruits had 11 sections and 5 to 6 seeds. This will continue to be Brazil's major export variety. It is suitable for processing.

Bahianinha orange. --This is a small fruited navel orange said to be a sport of the Bahia or Washington navel orange. The trees have the rounded appearance of Washington navel orange trees, and yield per tree is high. Most fruits are large and, unlike the Washington navel orange, have a closed navel. Samples of fruit had 11 sections and no seeds. This is Brazil's most important early export variety and represents about 30 percent of commercial acreage.

Hamlin orange. --This early Florida variety is the third most important export variety and represents about 5 percent of commercial acreage. Trees produce high yields of medium-sized fruit. This variety is said to be too acid for domestic taste and most production is exported.

Others. --About 35 to 40 percent of commercial acreage is planted to varieties suitable only for the domestic market. This group includes seedlings and named varieties of which the following are the most important:

The Washington navel (or Bahia) orange produces fruit too large for export. It represents about 5 percent of commercial production.

The Barão orange, a small, sweet, dry orange of good flavor, represents about 5 percent of commercial production.

Laranja lima (or sugar) orange is an early acidless fruit. It represents about 10 percent of commercial plantings.

COSTS

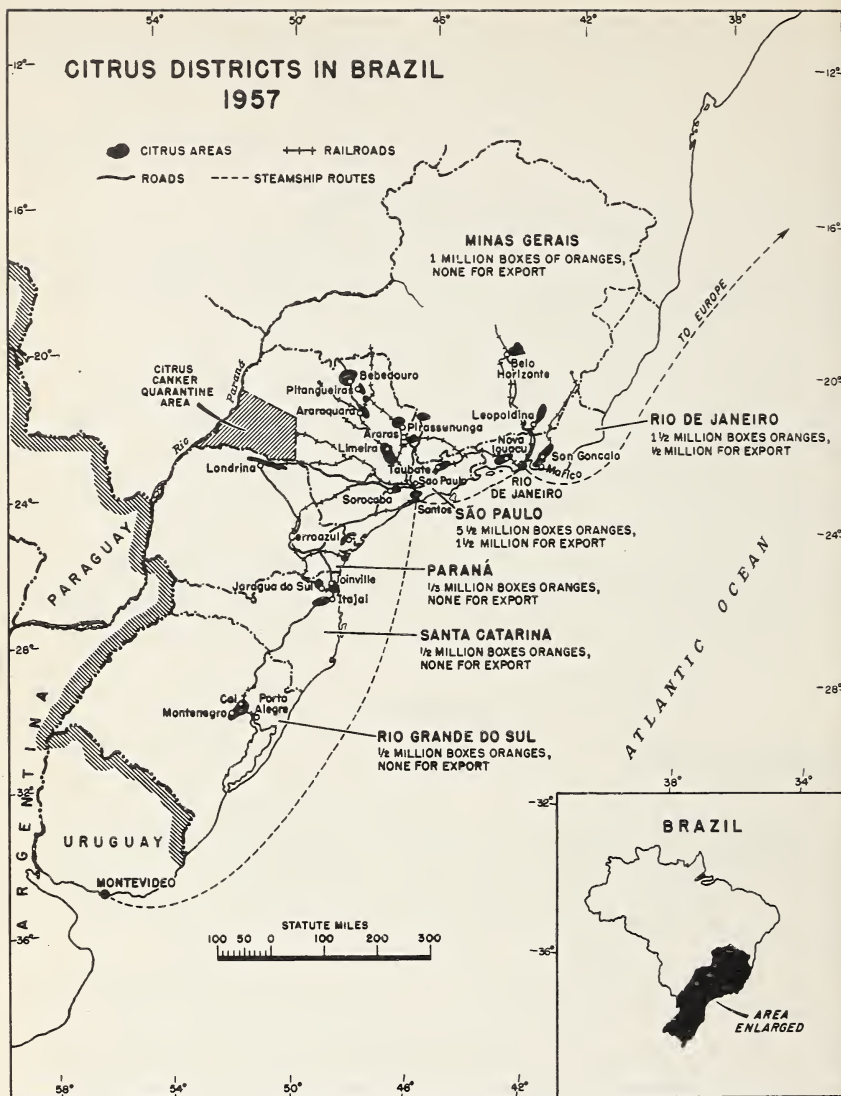
Operation Costs

Imported machinery and materials are major cost items in citrus grove operation. As the cruzeiro has dropped in value, the cost of imported items has increased. The estimated cost of planting and cultivating a grove to 3 years of age was \$72 to \$91 per acre in 1957. Tables 2 and 3 list some other cost items in 1957.

Costs vary greatly. Many growers do little or no pest control spraying or fertilization. Their costs are low, but they probably produce little export-grade fruit. A few growers spend as much as \$115 per acre for irrigation, heavy applications of fertilizer, and complete pest control programs.

Better grove care does not necessarily result in lower costs. It does result in larger percentages of export-grade fruit.

At a cost of operation of \$41 per acre, average yields may be estimated a 1-1/2 to 2 boxes per tree, about 130 to 175 boxes per acre, or a cost of about 23 to 32 cents per box. When as much as \$70 per acre is spent, average yields of 4 boxes per tree, 350 boxes per acre, are easily attained. Groves where as much as \$115 per acre is spent, and irrigation used, average yields have been shown to be about 6 boxes per tree, 525 boxes per acre. The cost of production in such a grove is about 22 cents per box.





Nursery trees were selling for 60 to 75 cents each near Limeira in 1957.



Fruit fly damage causes fruit to drop from trees. Some groves lose 25 to 50 percent of the crop in this way.



The two-compartment wooden export box is traditional for citrus, but a new half-box is being tried.

The costs have been generously estimated and the yields are conservative. Low yield data have been used to allow for the discard of fruit unsuitable for export or lost to the fruit fly. Also, fruit produced from out-of-season blooms has not been accounted for.

The 1957 cost of marketing export citrus is shown in table 4.

TABLE 2.--Citrus: Some items of cost, Brazil, 1957

Item	Unit	Cost	
		Cruzeiros	U. S. dollars ¹
Land suitable for citrus:			
Limeira.....	Hectare.....	40,000	
	Acre.....	---	.242
Bebedouro.....	Hectare.....	20,000	121-181
	Acre.....	30,000	---
Nursery trees.....	Each.....	40-50	.60-.75
Farm wages, including housing, etc.....	Per day.....	75-90	1.12-1.34
Jeep.....	Each.....	365,000	5,447.76
Chile nitrate.....	Ton.....	5,025	75.00
Tin cans, coated, with lid			
3 ounce.....	.....do.....	2.90	.043
16 ounce.....	.....do.....	5.30	.079
20 ounce.....	.....do.....	5.85	.087
1 U.S. gallon.....	.....do.....	18.00	.268

¹ Converted at 67 cruzeiros to the dollar.

TABLE 3.--São Paulo: Estimated cash cost of operating an orange grove, 1957

Item	Cost per hectare		Cost per acre
	Cruzeiros	U. S. dollars ¹	
Cultivation.....	1,000	6.04	
Pest control.....	1,200-2,000	7.25-12.08	
Fertilizer ²	2,000-6,000	12.08-36.24	
Depreciation on tractor and equipment.....	1,500	9.06	
Miscellaneous cultural expense.....	500	3.02	
Housing.....	500	3.02	
Taxes.....	20	.12	
Total.....	6,720-11,520	40.59-69.58	

¹ Converted at 67 cruzeiros to the dollar.

² Many growers use no fertilizer.

TABLE 4.--Oranges: Estimated average cost of production in Brazil and marketing in Europe, 1957

Item	Cost per box	
	Cruzeiros	U. S. dollars ¹
Cash cost of production.....	15.00-22.00	.22-.33
Cost of picking and packing.....	52.80-69.00	.79-1.03
Domestic freight.....	17.00-30.00	.25-.45
Break even cost, f.a.s. Santos.....	84.80-121.00	1.26-1.81
Freight to Europe		
12 shillings to U. K.....	---	1.68
13 shillings to Continent.....	---	1.82
Break even cost:		
C.i.f. U. K. ports.....	---	2.94-3.49
C.i.f. continental ports.....	---	3.08-3.63

¹ Converted at 67 cruzeiros to the dollar.

Growers receive little government assistance. Rail rates on fruit are reported to be kept below rates on other freight. Growers may obtain loans through the Banco do Brazil and the Carteira Agricola. Generally, the citrus industry is considered as a poor loan risk.

Break-even costs.

The estimated break-even costs, f.a.s. Santos, ranged from \$1.26 to \$1.81 per export box in 1957, table 4. The cultural cost is the smallest item of expense. Domestic freight costs more than the production of the fruit, and picking and packing cost is over 3 times as much. These high inflexible marketing costs are a disadvantage.

Break-even costs, c.i.f. continental European ports, are estimated to range from \$3.08 to \$3.63 per box. At 1957 costs, any continental European sales over \$4.00 per box paid cash costs, and sales of \$5.00 per box returned a profit.

MARKETING

Procedure

Marketing begins with the purchase of a crop on the tree by the fruit buyer. Purchasing may begin as early as January, while harvesting of even the earliest fruit does not start until April. Such forward buying is the result of the short orange supplies, but does not aid fruit quality. After selling the crop, the grower has no interest in the fruit and it is subject to disease and pest disfigurement. Forward buying requires large outlays of capital in a country where money cannot be borrowed except at very high interest rates. Fruit buyers will probably discontinue the practice of forward buying when orange supplies are more abundant.

The large fruit-buying firms are usually importers of Argentine deciduous fruit, as well as buyers, packers, wholesalers, and exporters of Brazilian citrus. There are a few large estates which have their own on-farm packing facilities and domestic and export marketing outlets. There are also nonexporting fruit buyers through which domestic fruit is sold. These firms handle a comparatively small volume of fruit.

Domestic sales provide the largest business of the citrus exporters. Because of the large size of Brazilian oranges and the high percentage of disfigured fruit it may be necessary for exporters to buy 3 or 4 boxes in order to obtain one box of export grade.

Trade sources reported that their average paying price on the tree in São Paulo was about 40 cruzieros, 80 cents¹ per 88 pound box in 1954, 65 cruzieros, \$1.30¹ in 1955, 100 cruzieros, \$1.49² in 1956 and 70 cruzieros, \$1.05² in 1957. The higher price in 1956 is reported to be due to increased demand caused by the freeze in Spain. These returns represent a substantial profit because most fruit is produced for less than 25 cents per box.

TABLE 5.--Oranges: Wholesale prices and volume of indicated varieties sold in one market by one firm, São Paulo, 1956

Month	Quantity sold						Wholesale price ¹	
	Bahia ²	Barão	Cravo ³	Hamlin	Pera	Total		
	1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes	Cruzeiros	U. S. dollars ⁴
January.....	(⁵)	---	---	---	1	1	227	3.39
February.....	(⁵)	---	---	---	(⁵)	(⁵)	210	3.13
March.....	2	(⁵)	2	(⁵)	(⁵)	4	197	2.94
April.....	14	1	9	(⁵)	---	24	161	2.40
May.....	12	1	12	3	---	28	106	1.58
June.....	9	1	10	1	3	24	93	1.39
July.....	21	2	1	(⁵)	10	34	88	1.31
August.....	23	9	---	3	6	41	108	1.61
September.....	1	---	---	---	15	16	115	1.72
October.....	(⁵)	---	---	---	13	13	124	1.85
November.....	2	---	---	---	7	9	170	2.54
December.....	2	---	---	---	4	6	208	3.10

¹ Price per 77-80 pound box.

² Includes all navels, Bahia, and Bahianinha.

³ A large tangerine.

⁴ Converted at 67 cruzeiros to the dollar.

⁵ Less than 500 boxes.

Picking and Packing. --Citrus is picked by the buyer and trucked to the packinghouse in wooden field boxes. Packinghouses are adequate and are equipped with Brazilian manufactured packing equipment. Half of all oranges are gassed to improve the color and color-add is used on early domestic and export fruits. Fungicide baths and diphenyl-treated paper wraps are used in some packinghouses to control decay.

A wooden two-compartment California-type box weighing 77 to 88 pounds gross is used for exports. Shippers are experimenting with a half-box wooden container and a half-box paper carton. Fruit exported to Argentina and Europe is wrap-packed. Domestic fruit is packed unwrapped in returnable and nonreturnable single compartment boxes.

Packing Cost. --Costs of packing vary with the type of operation and the distance from the port of Santos. Large growers packing their own fruit in an on-farm plant have lower costs than fruit buyers. Freight cost on packed fruit and materials is higher in the interior districts.

The cost of picking, packing, and transport of export oranges to the port of Santos ranges from \$1.04 to \$1.48 per box, as shown in table 6.

¹ Converted at 50 cruzieros to the dollar.

² Converted at 67 cruzieros to the dollar.

TABLE 6.--São Paulo: Estimated cost of picking, packing, and delivery to port of export oranges, 1957

Item	Cost per export box	
	Cruzeiros	U. S. dollars ¹
Picking.....	2.00-5.00	0.030-0.075
Hauling.....	1.50-5.00	.022-.075
Packing:		
Box.....	25.00-30.20	.373-.451
Lid.....	4.80	.072
Nails.....	1.20	.018
Wire.....	1.30	.019
Paper wraps, diphenyl.....	6.50	.097
Packing labor.....	3.00-5.00	.045-.075
Operation of packing house.....	7.50-10.00	.112-.149
Total packing cost.....	49.30-59.00	.736-.881
Total picking and packing cost.....	52.80-69.00	.788-1.030
Freight to Santos.....	17.00-30.00	.254-.448
Total cost f.a.s. Santos.....	69.80-99.00	1.042-1.478
Precooling.....	12.00	.179
Total cost, precooled f.a.s. Santos.....	81.80-111.00	1.221-1.657

¹ Converted at 67 cruzeiros to the dollar.

Domestic Freight Rates and Transport. --Transport from producing areas to Santos is excellent. Service is reliable and rapid. Rail freight costs in São Paulo on export oranges from the producing area to Santos are higher than the cost of producing the fruit and are unlikely to decrease in the future.

Fruit from areas closest to Santos, such as Campinas and Limeira, can be trucked to port in a few hours over excellent roads.

Sea Freight Rates and Transport. --In the past most exports have been made from Rio de Janeiro. In the future most exports will be made from Santos, table 7.

TABLE 7.--Oranges and grapefruit: Exports from Brazil, by destination and port of shipment, 1938-57

Year	Oranges						Grapefruit Total
	Destination			Port of shipment			
	Argentina	Europe	Other	Santos	Rio de Janeiro	Total	
	1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes
1938.....	1,207	4,212	78	1,828	3,669	5,497	184
1939.....	2,009	3,554	98	2,419	3,242	5,661	173
1940.....	2,007	838	18	779	2,084	2,863	1
1941.....	1,910	---	40	200	1,750	1,950	16
1942.....	1,274	---	7	178	1,103	1,281	---
1943.....	1,331	---	11	217	1,125	1,342	---
1944.....	1,261	---	10	273	998	1,271	---
1945.....	1,246	137	17	140	1,260	1,400	---
1946.....	1,014	1,745	9	505	2,263	2,768	---
1947.....	1,080	609	24	460	1,253	1,713	---
1948.....	1,536	1,124	185	380	2,465	2,845	---
1949.....	998	951	62	260	1,751	2,011	10
1950.....	1,270	1,147	---	312	2,105	2,417	9
1951.....	909	468	---	177	1,200	1,377	5
1952.....	380	423	---	170	633	803	2
1953.....	279	508	---	122	665	787	1
1954.....	(¹)	(¹)	---	300	693	993	3
1955.....	772	660	7	550	898	1,448	3
1956.....	153	1,063	9	910	315	1,225	7
1957.....	200	1,300	---	1,300	200	1,500	5

¹ Not available.

² Estimated.

In 1957, refrigerated freight from Santos or Rio de Janeiro to Europe was quoted at 12 shillings, \$1.68 per box to the United Kingdom and 13 shillings, \$1.82 per box to continental European ports. These rates apply to space on ships in regular scheduled service. Freight rates on ships not in regular service are reported to be much higher. Rates as high as 16 shillings, \$2.24, per box were reported. The trend of freight rates is up and it is unlikely that future sea freight from Brazil to Europe will be any less expensive.

Frequent sailings are available, but some exporters are concerned over the future prospect of space. However, refrigerated space will probably be available for all the fruit Brazil will be able to sell in European markets.

Nearly all ships in the South American-European service begin their voyage in Buenos Aires, Argentina, and stop at the Brazilian ports of Santos and Rio de Janeiro on their way to Europe. These ships may carry Argentine apples from Buenos Aires to Brazil and load Brazilian oranges for Europe.

Domestic Marketing

Brazilian citrus is grown primarily for the domestic markets. In 20 States, all production is consumed locally.

This discussion will concern only the two States--São Paulo and Rio de Janeiro--which supply all export fruit.

Brazil's domestic market demands different varieties and maturities of fruit than those suitable for export.

The domestic marketing season of the navel orange has two peaks in April-May and July-August (table 5). The marketing peak in April and May coincides with the export season of the Bahianinha--small navel orange. Domestic sales during this season are the residual sale of fruit picked for export. This early fruit is too acid for Brazilian tastes.

Export varieties which are not picked during the export season must be left on the tree for about 2 months until they are sweet enough to suit domestic tastes. The second marketing of navel oranges in July and August is such tree-stored fruit.

The domestic market is not complementary to export marketing. The tree-storing of export varieties for the domestic market exposes the fruit to damage from fruit flies and 25 to 50 percent of a crop may be lost.

Because citrus production is so widely scattered in Brazil, most urban consuming areas are near a citrus-producing district. There has been little development of a formal domestic citrus market in Brazil, except around the export centers of São Paulo and Rio de Janeiro. There is little interstate shipment of citrus. For these reasons, large quantities of domestic fruit are sold unpacked and ungraded.

Brazil's domestic citrus marketing is less developed than that of Argentina, where citrus has to be transported long distances from producing areas to noncitrus-producing markets.

Brazil's mild climate is a deterrent to the development of formal domestic marketing and to Brazil's export potential.

Wholesale Prices. --Domestic seasonal orange prices in 1956 averaged over \$3.00 per box, wholesale, in the summer months of short supply--November-March. In the winter months--April-September--when most oranges are sold, wholesale prices averaged only a little over \$1.50 per box (table 5).

Most of the summer oranges are cold-stored fruit, or from out-of-season blooms. Brazil's orange supplies are shortest in summer--the period of highest demand.

Domestic Consumption

Domestic consumption of oranges is highest in the citrus-producing areas in 22 States and in the major cities. Since the war, consumption in São Paulo has increased. In 1957, the estimated 4.5 million people consumed about 2.5 million to 3 million boxes of oranges and tangerines, or about 30 to 40 pounds per capita. Rio de Janeiro's 2.5 million people consumed about 1 million boxes of oranges and tangerines, or about 25 to 30 pounds per capita. Limitations on the growth of domestic consumption are purchasing power, short winter producing season, and fruit quality.

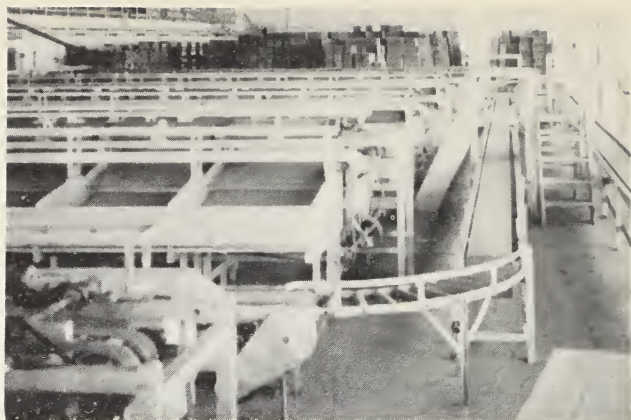
Brazilians now consume most citrus as fresh fruit. Should fresh or processed juice come into wide use, domestic consumption might increase, particularly in the large cities. In the immediate future, an average consumption level of about one-half box per person seems likely, and it will probably be a long time before this level is greatly increased. Low purchasing power of the consuming public is the most important limiting factor.

Export Marketing

Orange exports, which totaled over 5 million boxes in 1938 and 1939, declined steadily, because of disease and war, to less than 1.5 million boxes by 1945 (table 7).

Exports in 1946-50 averaged about 2.3 million boxes annually as fruit was sold to Western Europe under compensation-barter agreements. In the next 4 years, exports declined to less than 1 million boxes a year--the lowest level in the past 25 years. Tristeza had so reduced production that export fruit was not available in greater volume, domestic prices were high, and the discontinuance of compensation trading made exporting less profitable.

Since 1954, exports have increased as larger quantities of fruit have become available in São Paulo. In 1957, about 1 million boxes of oranges were exported from the port of Santos and 500,000 boxes from Rio de Janeiro. About 900,000 boxes were of the Pera variety, about 250,000 were navel oranges, and about 350,000 unspecified, probably mostly Hamblins.



São Paulo's packinghouses use Brazil-made machinery.



The expanding export orange potential in São Paulo from impressive new groves like those at Bebedouro above and Pitangueiras below may be short-lived because of new disease problems with exocortis and gummosis.



Lemon exports--always less than 10,000 boxes per year--have not been consistent. In 1956, less than 2,000 boxes were exported to the United Kingdom. Grapefruit exports also are negligible.

Export Season. --Brazil exports oranges during the Northern Hemisphere summer from March to November (table 8).

TABLE 8.--Oranges: Exports from Brazil by month, 1955, and country of destination 1938, 1939, 1955, 1956 and potential exports 1965

Month	Argentina	Europe	Total	Country of destination ¹	1938	1939	1955	1956	1965 ¹
	1,000 boxes	1,000 boxes	1,000 boxes		1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes	1,000 boxes
January.....	---	---	---	Belgium.....	538	470	23	12	400
February.....	44	---	44	France.....	129	75	198	522	700
March.....	6	---	6	Germany.....	621	272	69	30	500
April.....	15	18	33	Netherlands....	535	591	35	98	500
May.....	8	59	67	Sweden.....	49	88	---	---	100
June.....	1	129	130	United Kingdom..	2,340	2,058	344	401	1,000
July.....	12	164	176	East. Europe....	---	---	---	---	300
August.....	59	164	223						
September.....	95	61	156	Total Europe..	4,212	3,554	669	1,063	3,500
October.....	252	---	252						
November.....	202	8	210	Other.....	78	98	7	9	250
December.....	6	11	17	Argentina.....	1,207	2,009	772	153	250
Unspecified.....	---	---	134						
Total.....	700	614	1,448	Total exports.	5,497	5,661	1,448	1,225	4,000

¹ Forecast.

Exports to Europe in volume are made from May through September. These consist of about 20 percent unspecified, mostly early Hamlins, 15 percent navel oranges, and about 66 percent late Peras. Exports to Argentina are in October, November, and December following the European export season. All exports to Argentina are the late Pera orange and in the past all exports to Argentina have been made from Rio de Janeiro.

Brazil's orange marketing season in Europe is from about June 15 to October 15. In the future, as more fruit is exported from São Paulo the orange marketing season in Europe may end a month earlier.

Export Customers. --Brazil has exported oranges to Argentina consistently for the last 35 years (table 7). Trade has been accomplished by trade agreements, under which Brazil exports oranges and bananas and imports deciduous fruits.

England, Brazil's major European customer, is now importing less and is supplied in summer by a non-duty-paying colony. In 1938 and 1939 Brazil exported over 2 million boxes of oranges to the United Kingdom (table 8). At this time England was the world's largest orange importer, buying 16.5 million to 17 million boxes per year. In 1955 and 1956 it imported less than 12 million boxes of oranges annually--less than 500,000 boxes per year came from Brazil. However, in these years over 3 million boxes of summer oranges were imported from South Africa each year. Attempts by South Africa to increase its volume of sales in England have resulted in lower prices.

Since Brazil cannot hope to regain its prewar export volume in England, it will be necessary to increase exports sales in continental Europe. The potential Brazilian export of 4 million boxes is allocated arbitrarily in table 8. This is an attempt to show a plausible distribution of sales in 1965 considering the new market conditions, and it illustrates the problem confronting Brazil's future in Europe.

While Brazil has been out of the European market, competing fruit has become well established. Brazil will meet very severe competition in any attempt to regain European markets.

Export Standards. --The Brazilian Ministry of Agriculture has established and enforces minimum export standards. Export oranges must contain 40 percent juice and have a peel 50 percent naturally colored. Only 15 percent of standard grade fruit may have peel defects according to a 1957 amendment. Oranges from São Paulo and southern Brazil must have juice with a 1 to 6.5 sugar-acid ratio and from Rio de Janeiro and the Brazilian coastal plain a 1 to 8 sugar-acid ratio. In addition, oranges may be artificially colored under authorization by the Ministry of Agriculture.

Export grapefruit must have 50-percent naturally colored peel, 30-percent juice, and juice with a sugar-acid ratio of 1 to 5 in São Paulo and southern Brazil. In Rio de Janeiro and the Brazilian coastal plain a 1 to 6.5 sugar-acid ratio is required. Fancy grade must contain fruit with no more than 5-percent peel defects and choice grade no more than 30-percent defects.

Lemons for export must contain 40-percent juice and have no more than 30 percent of fruit with peel defects.

Tests of juice indicate that Brazilian citrus fruit usually have no difficulty in meeting the minimum sugar-acid ratios.

The high percentage of permitted peel defects illustrates the difficulty of maintaining export grades with Brazil's disease and pest problems. At the port of shipment precooled fruit must show no more than 1.5 percent decay and other fruit no more than 1 percent decay.

Export Prices. --Exporters may sell f. a. s. Santos or ship directly to their own firm or agent in Europe. Usual practice is to sell fruit f. a. s. Santos even though the export is to another branch of the same firm. Foreign exchange regulations may be one reason for this practice.

The bank of Brazil establishes minimum export prices--\$1.88 per box f. o. b. Brazil for oranges in 1957. In 1957 export sales were reported to range from 20 to 25 shillings \$2.80 to \$3.50 per box f. a. s. Santos. At 1957 refrigerated freight rates this fruit was landed at continental European ports at a cost of about \$4.62 to \$5.32 per box.

Exchange Problems. --Since World War II Brazil's economy has experienced a period of inflation which has resulted in unstable currency values. The cruzeiro in 1957 had about half the 1950 value. The Brazilian government has developed one of the most complicated exchange systems in the world

involving minimum export prices and multiple exchange rates. Export regulations and exchange rates are much more important to the Brazilian citrus exporter than are world citrus prices or domestic costs.

From 1946 to 1951 oranges were exported to Europe under compensation agreements. Brazilian exporters of citrus used their earnings to import badly needed goods and equipment into Brazil. Since 1951 all exports have been made under controlled exchange regulations by which citrus exports have always earned less than the free rate of exchange--a distinct disadvantage to citrus exporters.

In 1953, when the free rate ranged from 40 to 45 cruzeiros to the dollar, citrus exporters received about 30 cruzeiros to the dollar for export sales. In 1954, when the free rate was about 70 cruzeiros, citrus exporters received 37. In 1956 the free rate reached 80 cruzeiros to the dollar, but citrus exporters received about 56. This was raised to 67 cruzeiros in 1957 and the free rate reached 94.

The effect of these controls has been to decrease export earnings and to increase the price of Brazilian oranges in world markets.

The effective export price of Brazilian citrus may be changed at any time by an adjustment in the foreign exchange regulations or rate. Exporter earnings may also be increased and the price lowered if exporters resorted to the practice of "underinvoicing". By this practice uncontrolled foreign exchange is earned by reporting export sales at less than the actual sales price.

Market Acceptance of Brazilian Oranges. --Brazilian oranges usually sell at lower prices in Western European markets than does California and Florida fruit (table 9).

There is nothing outstanding about the appearance of Brazilian oranges. Disease and insect blemishes are common. Export standards in 1957 permitted 15 percent of some fruit to have peel defects. Half of exports have to be gassed or colored. Some export fruit is from out-of-season blooms which results in lack of uniformity in packs.

Brazilian oranges have a poor reputation in Europe for arrival condition and keeping qualities. Lots with decay sell at low prices. This is illustrated in price comparisons in Rotterdam. Fruit flies, stem-end rot, the necessity, at times, of picking fruit from wet trees, and the humid climate in export ports are all conditions contributing to transport problems.

Sizes of Brazilian oranges from the State of São Paulo are larger than U. S. export sizes (table 10). The Washington navel orange is not exported because it is too large. Even the "small" navel orange produces 30 percent to 40 percent of fruit size 126 and larger, mostly too large to export. The Hamlin and the late Pera produce smaller fruits.

TABLE 9.--Oranges: Comparison of auction prices, size 288, from Argentina, Brazil, South Africa, California, and Florida at Rotterdam, specified dates June-December 1956

Month and day	Argentina	Brazil	South Africa	California	Florida
	U. S. dol. per box ¹	U. S. dol. per box ¹	U. S. dol. per box ¹	U. S. dol. per box ²	U. S. dol. per box ³
June:					
7.....	---	6.89	---	7.34-8.14	7.74-8.40
28.....	---	5.65-6.05	6.44-7.23	6.58-7.10	---
July:					
5.....	---	2.63-4.86	5.00-7.10	4.34-6.04	5.52-6.04
10.....	---	---	5.98-6.18	5.38-6.84	---
19.....	---	4.47-5.78	4.69-6.31	5.78-7.76	5.00-5.26
24.....	---	---	---	4.34-7.64	---
August:					
2.....	---	5.27-6.32	5.66-6.65	6.98-7.80	---
9.....	---	4.27-5.46	6.84-7.65	7.62-8.80	3.16-4.20
14.....	---	5.78-6.11	---	8.16-8.94	---
23.....	---	3.36-4.21	5.07-5.26	4.60-6.18	---
30.....	---	---	4.87-5.72	6.06-8.42	---
September:					
6.....	---	2.50-3.09	5.13-5.79	5.92-7.76	---
13.....	5.14-5.40	---	5.47-6.12	5.40-5.79	---
20.....	---	---	5.07-5.93	6.20-7.50	---
27.....	---	---	5.74-6.14	5.94-7.26	---
October:					
4.....	---	---	6.12-7.38	5.54-7.90	---
11.....	---	---	6.32-6.72	5.80-7.64	---
18.....	6.98	---	6.98-7.24	7.12-8.96	---
25.....	6.72-6.98	---	7.31-7.51	5.26-8.42	---
November:					
1.....	---	4.74-6.32	7.84-8.23	6.98-9.08	---
8.....	6.59	6.59-6.91	7.97-8.17	5.26-10.28	6.58
15.....	6.45-6.78	---	6.91-7.18	5.54-8.96	8.30-8.42
22.....	6.72	---	7.11-7.77	3.96-10.14	6.72-8.04
29.....	6.78-7.51	5.00-5.40	7.38-7.44	8.96-10.66	---
December:					
6.....	6.60	---	---	6.58-7.12	7.12-7.78
13.....	---	---	---	8.84-9.24	6.06-8.44
20.....	---	---	---	---	6.46-7.66
28.....	---	---	---	6.86-8.84	---

¹ 78-88 pound boxes.

² 71-84 pound boxes or 2 cartons.

³ 86-90 pound boxes.

Reuters reports on auction prices.

TABLE 10.--Oranges: Comparison of size composition of oranges produced in Brazil with California, Florida, and South African export sizes, 1957

Size	Brazil					United States		South Africa	
	São Paulo				Rio de Janeiro	California Valencia ³	Florida Valencia ³	Navel ⁴	Valencia ⁴
	Wash. Navel (Bahia) ¹	Small Navel (Bahia-ninha) ¹	Hamlin ²	Pera ²	Pera ³				
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
80.....	10	1	---	---	---	---	---	2	---
96.....	28	9	---	---	---	---	---	8	---
112.....	25	16	---	---	---	---	---	9	2
126.....	12	16	1	8	---	---	---	27	5
150.....	10	18	1	16	---	---	---	22	11
176.....	7	16	2	25	3	---	---	12	18
200.....	3	11	3	22	3	---	---	10	11
216.....	4	7	18	16	10	---	48	2	22
252.....	1	6	32	9	25	8	39	5	15
276.....	---	---	---	---	---	27	---	---	8
288.....	---	---	24	3	18	---	10	2	5
324.....	---	---	12	1	25	29	3	1	3
344.....	---	---	6	---	---	---	---	---	---
360.....	---	---	1	---	16	36	---	---	---

¹ Dr. Silvio Moreira, Instituto Agronomico - Campinas.

² Pitangueiras, São Paulo.

³ Rotterdam auction catalogues July 1957.

⁴ South African Cooperative Shipping Service, Ltd., Report on Shipping, Clearing, and Forwarding, 1955.

The Pera orange of São Paulo is larger than the Pera orange produced in Rio de Janeiro. The preponderance of young trees in São Paulo, which tend to produce large fruit, will increase the orange size problem, making Brazil less competitive with small California fruit.

The sizes of oranges exported from California usually range from 252 to 360 and Florida sizes range from 176 to 324. Table 10 illustrates the size of California and Florida fruit sold on one day in July 1957. This is the usual range of export sizes but not necessarily the average export size distribution. U. S. export orange sizes are complementary to both Brazilian and South African orange sizes.

In June 1957 Florida oranges brought more than the Brazilian product on the Rotterdam auction (table 11). California Valencias sold at over \$2.00 per box more than the São Paulo Peras. The same was true in July. In November both California and Florida oranges sold at higher prices than Pera oranges from Rio de Janeiro. The smaller Pera oranges from Rio de Janeiro are more competitive on a size basis.

TABLE 11.--Oranges: Comparison of auction prices of Brazil, California, Florida, and South Africa by size and variety, at Rotterdam, on specified days, 1957¹

Size	June 12				July 10			November 7			
	Brazil São Paulo, Pera	Valencia		South Africa Navel	Brazil São Paulo, Pera	Calif- ornia, Valen- cia	South Africa Navel	Brazil, Rio de Janeiro Pera	Calif- ornia, Valen- cia	Florida, Hamlin	South Africa Valen- cia
		Calif- ornia	Flor- ida								
	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box	U.S. dol. per box
80...	---	---	---	6.10	---	---	---	---	---	---	---
112...	---	---	---	6.30	---	---	---	---	---	---	---
126...	---	---	---	6.89	---	---	---	---	---	---	7.90
150...	4.46	---	---	7.48	6.10	---	---	---	---	7.37	---
176...	4.79	---	---	7.68	7.03	---	9.71	7.70	---	7.90	9.08
200...	5.25	---	---	7.75	8.03	---	---	7.70	---	---	9.08
216...	5.32	---	6.56	7.75	8.61	---	---	7.70	10.52	7.90	9.08
252...	6.17	---	6.70	8.20	9.15	---	10.78	7.76	---	8.02	9.28
276...	---	8.53	---	---	---	---	---	---	11.28	---	---
288...	6.70	---	6.70	8.47	9.78	---	11.06	7.76	---	8.02	9.21
324...	---	---	6.83	8.47	---	---	11.42	7.83	---	8.02	8.74
326...	---	9.06	---	---	---	12.04	---	---	11.28	---	---
360...	---	9.06	---	---	---	11.34	11.56	7.83	11.14	7.83	8.74
420...	---	9.71	---	---	---	11.34	---	---	---	---	---
442...	---	---	---	---	---	---	11.27	---	---	---	7.24

¹ Prices per box or 2 cartons.

Trade reports on auction prices. Converted at official rates of exchange.

Brazilian oranges, because of their appearance, condition and size are not directly competitive with California fruit. The shift in the source of exports to São Paulo will probably result in Brazil being less competitive than in the past. Good quality oranges from California and to a lesser extent Florida may be expected to continue to sell at substantial premiums over Brazilian oranges.

PROCESSING

Brazil has a very small potential for processing. Production is scattered and, even in São Paulo, only small quantities of fruit are suitable for products. About a third of production is of low-acid varieties for the local market. These fruits tend to have low solids and are a poor source of juice. An important part of production consists of navel oranges which produce acid, bitter juice and are a poor processing variety.

The Pera orange is suitable for products, but is usually high priced. Seedling oranges are a good source of juice, but are not produced in quantity in commercial citrus districts. Some Hamlins are available, but these are in demand for export. The juice characteristics of several varieties are shown in table 12.

TABLE 12.--Citrus juice: Characteristics of specified varieties, Campinas, State of São Paulo, 1956

Variety	Month of test	Root stock	Juice characteristics			
			Juice content	Acid content	Sugar-acid	Brix
Lemons:			Percent	Percent	Ratio	Ratio
Eureka.....	May.....	Sour orange...	34.3	6.38	1:1.7	10.8
Oranges, domestic type: ¹						
Laranja Lima.....	....do....	Rangpur lime..	50.0	.13	1:66.9	8.4
Laranja Lima.....	....do....	Sour orange...	56.6	.10	1:87.2	8.7
Barao.....	July.....	Sweet orange..	41.2	.37	1:25.7	9.5
Oranges, export type:						
Early oranges: ¹						
Hamlin.....	May ².....	.....do.....	36.1	1.14	1:9.3	10.6
Bahianinha ³.....	....do....	Rangpur lime..	40.9	.67	1:15.6	10.5
Bahianinha ³	June.....	Sweet orange..	46.2	.85	1:14.2	12.1
Late oranges: ⁴						
Pera.....	May.....	.....do.....	44.7	1.04	1:9.3	9.6
Pera.....	....do....	Sweet lime....	39.4	2.05	1:4.5	9.2
Pera.....	September ²	Sweet orange..	51.1	1.03	1:14.0	14.4
Lue Gim Gong.....	May.....	Rangpur lime..	36.1	3.79	1:2.9	11.0
Valencia.....	....do....	Sweet orange..	37.1	2.37	1:4.5	10.7
Natal.....	....do....	.....do.....	42.8	1.73	1:5.5	9.5

¹ Harvested April-August.

² Tests in May are comparable to December tests in Florida. September tests at Campinas are comparable to April in Florida.

³ Small navel oranges.

⁴ Harvested July-November.

Instituto Agronomico, Campinas.

There seems to be little demand for citrus juice in Brazil and no large processing plants exist. One soft drink bottler concentrates orange juice in São Paulo for use in an orange drink.

In 1957, most processing consisted of the extraction of essential oil by fresh fruit packers who use dropped and unsalable fruit.

Lemon oil is in greatest demand and trade sources estimate that in 1956 Brazil produced about 25,000 pounds of raw lemon oil compared with about 5,000 pounds of raw orange oil.

Lemons are reported to yield about 8 1/2 to 10 pounds of oil per metric ton of fruit.

In 1957, the price of lemon oil in São Paulo was about 750 cruzeiros per kilo (\$5.08 per pound) while orange oil averaged 400 to 450 cruzeiros per kilo (\$2.71 to \$3.05 per pound). This price differential illustrates the preference for lemon oil.

Some neroli (orange flower oil) and petitgrain (orange leaf oil) are also made. One grower raises bitter orange trees for this purpose. At the time of bloom the outside leaves and blossoms are clipped off the tree. The cuttings are distilled in water and the orange flower oil and petitgrain are separated mechanically. This process is said to produce a commercially satisfactory product.

A modern processing plant using U.S. machinery with a capacity of 2 million boxes of fruit per year is in the planning stage at Bebedouro. Canning juice would be expensive. A number 2 can with lid cost processors 0.087 U.S. cent each in 1957 (table 2). Marketing the products of such a plant in Brazil might be a major problem. A juice plant at Limeira does not operate.

The presence of fruit flies might result in orange and grapefruit juice having defects in some lots because of the presence of insect eggs and fly larva. Orange and grapefruit juice with such defects could not be imported into the United States.

There may be some increase in orange juice production for domestic use. Some lemon juice and essential oil will also be produced, the quantity depending on local demand.

Should Brazil produce juice or essential oil for export it would be in competition with the world, abandoning the seasonal advantage its fresh fruit exports enjoy. It has no natural advantages for the development of a major processing industry, so little or no products competition should be expected.

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